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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Fufang Zha et al.
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For:	METHODS OF CLEANING MEMBRANE MODULES
Examiner:	Menon, Krishnan S.
Art Unit:	1797

CERTIFICATE OF TRANSMISSION UNDER 37 C.F.R. § 1.8(a)

The undersigned hereby certifies that this document is being electronically filed in accordance with § 1.6(a)(4), on the 12th day of November, 2009.

Gregory Gerstenzang, Reg. No. 59,513

Commissioner for Patents

Declaration of Dr. Fufang Zha Under 37 CFR 1.132

Sir:

I, Dr. Fufang Zha, of 15A Grand Avenue, West Ryde, New South Wales 2114, Australia hereby declare:

1) I graduated from the University of New South Wales in 1994 with a Ph.D. in Chemical Engineering. My other degrees include Master of Chemical Engineering from Zhejiang University and Bachelor of Chemical Engineering from Hefei University of Technology.

2) I have 21 years of experience in the field of filtration technology, and especially membrane filtration technology. I am a named inventor on several patents related to membrane filtration technology, including, for example, U.S. Patent Nos. 6,156,200, 6,555,005, 6,524,481, 6,641,733, 6,821,420, 6,783,008, and 6,974,554.

3) I am Global Director of Wastewater Process Technology at MEMCOR Products, 1 Memtec Parkway, South Windsor, New South Wales 2756, Australia, which is part of Siemens Water Technologies Corp. As Global Director of Wastewater Process Technology, I provide technical advice to global company engineers and review technical documents in water and

wastewater process technology. Thus, I am familiar with the field of membrane filtration devices, commercial applications, manufacturing, and the various limitations associated with particular designs and materials of construction.

4) I am a co-inventor in the present application.

5) I have read and understood the responses previously presented during the prosecution of the present application. I agree with the logic presented in these responses.

6) I understand that in the examination of this application, that claims 1, 4-11 and 24-28 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of U.S. Patent No. 5,403,479 to Smith (hereinafter "Smith") and/or U.S. Patent No. 5,209,852 to Sunaoka et al. (hereinafter "Sunaoka") and/or U.S. Patent No. 5,643,455 to Kopp et al. (hereinafter "Kopp") and/or U.S. Patent Publication No. 2001/0052494 to Cote et al. (hereinafter "Cote") and/or JP 11076769.

7) I have read and understand each of Smith, Sunaoka, Kopp, Cote, and JP 11076769.

8) Smith does not disclose or suggest a membrane filtration apparatus or method involving the following acts recited in independent claim 1 of the present application:

- isolating the lumens of the membranes, the manifold, and a portion of piping through which permeate is withdrawn during filtration when the filtration process is stopped;
- performing a gas scouring of surfaces of the membranes;
- applying a gas to a portion of liquid permeate present in the isolated lumens, manifold, and portion of piping through a gas inlet on a side of a valve in direct fluid communication with the membrane module;
- directing the portion of liquid permeate into the membrane module through a first end of the membrane module and through a second end of the membrane module;
- introducing a gas into the membranes which does not penetrate into the membrane pores;
- discharging backwash waste from the vessel;
- refilling the vessel with feed liquid; or

- venting gas from the isolated lumens, manifold, and portion of piping.

9) As one of ordinary skill in the art, at the time of invention of the present invention I would not have been motivated to have modified Smith in light of any of Sunaoka, Kopp, Cote, and JP 11076769 to perform each of the acts recited in independent claim 1 of the present application listed above.

10) As one of ordinary skill in the art, I would not have been motivated to have modified the apparatus disclosed in Smith to provide for gas scouring of surfaces of the membranes. Smith discloses that a biocidal solution is required for cleaning of the membranes. There is no disclosure or suggestion in Smith that gas scouring would provide any benefits or improve upon the cleaning method disclosed. In an open tank as described in Smith system, gas scouring during chemical cleaning would generate environmentally unfriendly gases, a result that I would seek to avoid. Further, for wastewater treatment applications, air scouring during chemical cleaning would create significant foaming that is difficult to control, a result that I would also seek to avoid.

11) As one of ordinary skill in the art, I would not have been motivated to have modified the apparatus disclosed in Smith to provide for applying a gas to a portion of liquid permeate present in the isolated lumens, manifold, and portion of piping through a gas inlet on a side of a valve in direct fluid communication with the membrane module. I would have found it desirable to remove as much valuable liquid permeate from the membrane filtration system as possible, and I believe that the method of Smith would have advantageously been performed such that permeate would have been drained from the header and/or piping and/or lumens before applying a biocidal gas to the membrane modules. It would have been advantageous to increase the amount of permeate formed between back flushing cycles, to increase the efficiency of the system. Further, if liquid permeate were present in the header and/or lumens upon the application of the biocidal gas, some of the biocidal gas could dissolve in permeate remaining in the header and/or lumens. This would be undesirable as the permeate would then carry the dissolved gas through the hollow fiber membranes and into the reservoir in which the membranes are immersed where it could kill beneficial microbes – a result that would be undesirable in the method of Smith.

12) As one of ordinary skill in the art, I would not have been motivated to have modified the apparatus disclosed in Smith to provide for directing the portion of liquid permeate into the membrane module through a first end of the membrane module and through a second end of the membrane module. To do so would render the device of Smith incapable of performing according to the method disclosed in Smith. Smith discloses a check valve 26 which is necessary to enable cleaning of the membrane lumens by circulating a biocidal liquid through them. This check valve prevents biocide (or liquid permeate) from being applied to both ends of the membrane fibers – liquid could not be directed into the membrane fibers through the downstream header 11'. As such, the device of Smith could not perform an act of directing the portion of liquid permeate into the membrane module through a first end of the membrane module and through a second end of the membrane module. Removing the check valve 26 such that the device of Smith could perform this act would render the device incapable of circulating biocidal solution through the lumens of the fibers and returning it to the storage tank 27 as disclosed in Smith.

13) As one or ordinary skill in the art, I would not have been motivated to have modified the apparatus or method disclosed in Smith to provide for introducing a gas into the membranes which did not penetrate into the membrane pores. In the method of Smith a biocidal gas must pass through the pores of the membrane and chemically react with foulant on the outside of the membranes to remove it.

14) Sunaoka does not disclose or suggest a membrane filtration apparatus or method involving the following acts recited in independent claim 1 of the present application:

- supplying a gas into membrane fibers at a pressure less than a bubble point of the membranes;
- directing the portion of liquid permeate into the membrane module through a first end of the membrane module and through a second end of the membrane module;
- introducing a gas into the membranes which does not penetrate into the membrane pores; or
- venting gas from the isolated lumens, manifold, and portion of piping.

15) As one of ordinary skill in the art, I would not have been motivated to have modified Sunaoka in light of any of Smith, Kopp, Cote, and JP 11076769 to perform each of the acts recited in independent claim 1 of the present application listed above.

16) For example, as one of ordinary skill in the art, I would not have been motivated to have modified the system of Sunaoka such that it was capable of performing a method including supplying a gas into membrane fibers at a pressure less than a bubble point of the membranes such that the gas did not penetrate the membrane pores. The process of Sunaoka requires that filtrate flow from the inside of the hollow fiber membranes to the outside thereof to effect backwash. Sunaoka is silent as to the pressure of the compressed gas utilized to push the filtrate through the membranes. The compressed air utilized by Sunaoka would preferably be compressed to a high pressure, e.g. above the bubble point of the membranes, to provide a significant force to remove particles from the membrane pores during backwashing and to reduce the time required for backwashing the membranes.

17) As one of ordinary skill in the art, I would not have been motivated to have modified Sunaoka to provide for directing the portion of liquid permeate into the membrane module through a first end of the membrane module and through a second end of the membrane module. To modify the apparatus of Sunaoka in this manner would require a significant change to the structure and operation of the disclosed apparatus. This modification would require the addition of additional piping, valves, and other components to the apparatus of Sunaoka, which would only have increased the complexity and cost of said apparatus, while not providing a solution to any disclosed problem with said apparatus.

18) Kopp does not disclose or suggest a membrane filtration apparatus or method involving the following acts recited in independent claim 1 of the present application:

- isolating the lumens of the membranes, the manifold, and a portion of piping though which permeate is withdrawn during filtration when the filtration process is stopped; or
- directing the portion of liquid permeate into the membrane module through a first end of the membrane module and through a second end of the membrane module;

19) As one of ordinary skill in the art, I would not have been motivated to have modified Kopp in light of any of Smith, Sunaoka, Cote, and JP 11076769 to perform each of the acts recited in independent claim 1 of the present application listed above.

20) As one of ordinary skill in the art, I would not have been motivated to have modified the system of Kopp to provide for directing the portion of liquid permeate into the membrane module through a first end of the membrane module and through a second end of the membrane module. To modify the apparatus of Kopp in this manner would require a significant change to the structure and operation of the disclosed apparatus. This modification would require the addition of additional piping, valves, and other components to the apparatus of Kopp, which would only have increased the complexity and cost of said apparatus, while not providing a solution to any disclosed problem with said apparatus.

21) Cote does not disclose or suggest a membrane filtration apparatus or method involving the following acts recited in independent claim 1 of the present application:

- isolating the lumens of the membranes, the manifold, and a portion of piping though which permeate is withdrawn during filtration when the filtration process is stopped;
- supplying a gas into membrane fibers at a pressure less than a bubble point of the membranes;
- applying a gas to a portion of liquid permeate present in the isolated lumens, manifold, and portion of piping through a gas inlet on a side of a valve in direct fluid communication with the membrane module;
- introducing a gas into the membranes which does not penetrate into the membrane pores; or
- venting gas from the isolated lumens, manifold, and portion of piping.

22) As one of ordinary skill in the art, I would not have been motivated to have modified the apparatus or method disclosed in Cote in light of any of Smith, Sunaoka, Kopp, and JP 11076769 to perform each of the acts recited in independent claim 1 of the present application listed above.

23) For example, as one of ordinary skill in the art, I would not have been motivated to have modified the system of Cote such that it was capable of performing a method including isolating

the lumens of the membranes, the manifold, and a portion of piping though which permeate is withdrawn during filtration when the filtration process is stopped. Cote discloses a method of backwashing in which permeate from a storage tank 62 is pumped through backwash valves 60 and backwash piping 63. To have modified the apparatus of Cote to provide for isolating the lumens of the membranes, the manifold, and a portion of piping though which permeate is withdrawn during filtration as recited in claim 1 of the present application would have made it impossible to deliver permeate from the permeate storage tank through the permeate pump, backwash valve, and associated piping to effect backwash as disclosed.

24) Cote discloses a method of backwashing by pumping permeate in a reverse direction through membrane fibers. Cote does not disclose or suggest using any gas to push permeate through the membrane fibers. As one of ordinary skill in the art, I would not have been motivated to have modified the system of Cote such that it was capable of performing a method including supplying a gas into membrane fibers at a pressure less than a bubble point of the membranes, applying a gas to a portion of liquid permeate present in the isolated lumens, manifold, and portion of piping through a gas inlet on a side of a valve in direct fluid communication with the membrane module, introducing a gas into the membranes which does not penetrate into the membrane pores, or venting gas from the isolated lumens, manifold, and portion of piping. To make a modification to the system of Cote such that it could perform these acts recited in independent claim 1 of the present application would require a fundamental change to the structure and operation of the apparatus of Cote while providing no further benefit or providing a solution to any disclosed problem with said apparatus.

25) JP 11076769 does not disclose or suggest a membrane filtration apparatus or method involving the following acts recited in independent claim 1 of the present application:

- isolating the lumens of the membranes, the manifold, and a portion of piping though which permeate is withdrawn during filtration when the filtration process is stopped;
- performing a gas scouring of surfaces of the membranes;
- applying a gas to a portion of liquid permeate present in the isolated lumens, manifold, and portion of piping through a gas inlet on a side of a valve in direct fluid communication with the membrane module;

- directing the portion of liquid permeate into the membrane module through a first end of the membrane module and through a second end of the membrane module;
- discharging backwash waste from the vessel; or
- venting gas from the isolated lumens, manifold, and portion of piping.

26) As one of ordinary skill in the art, I would not have been motivated to have modified JP 11076769 in light of any of Smith, Sunaoka, Kopp, and Cote to perform each of the acts recited in independent claim 1 of the present application listed above.

27) For example, as one of ordinary skill in the art, I would not have been motivated to have modified the system of JP 11076769 such that it was capable of performing a method including isolating the lumens of the membranes, the manifold, and a portion of piping though which permeate is withdrawn during filtration when the filtration process is stopped. Making this modification to JP 11076769 would have made it impossible for the apparatus of JP 11076769 to deliver permeate from the permeate tank 13 through the pump 15 to backwash the membranes as disclosed.

28) As one of ordinary skill in the art, I would not have been motivated to have modified the system of JP 11076769 to provide for performing a gas scouring of surfaces of the membranes. JP 11076769 is directed to a method of cleaning a membrane filtration module with permeate backwashing and occasional cleaning with a "drug solution." There is no indication or suggestion that any form of aeration would provide any benefits over the backwashing or cleaning with the drug solution disclosed. Adding an aeration system to the apparatus disclosed would increase the cost and complexity of the system while providing no further benefit or providing a solution to any disclosed problem with said apparatus.

29) As one of ordinary skill in the art, I would not have been motivated to have modified the system of JP 11076769 to provide for applying a gas to a portion of liquid permeate present in the isolated lumens, manifold, and portion of piping through a gas inlet on a side of a valve in direct fluid communication with the membrane module. In JP 11076769, it appears that gas is applied directly to a membrane module after the membrane module has been removed from a filtration assembly (FIG. 1) and attached to a chemical cleaning assembly (FIG. 2). There is no disclosure or suggestion that any permeate remains in the lumens or manifold of the membrane

module when attached to the chemical cleaning apparatus, nor is there any disclosure or suggestion that permeate is present in any piping of the chemical cleaning apparatus. Further, I would not have been motivated to have combined the chemical cleaning apparatus of FIG. 2 of JP 11076769 with the filtration assembly of FIG. 1 and perform a method including applying a gas to a portion of liquid permeate present in the isolated lumens, manifold, and portion of piping through a gas inlet on a side of a valve in direct fluid communication with the membrane module because this would require a fundamental change to the system and operation of the apparatus of JP 11076769, and further because there would be no benefit or advantage to applying the gas to anything but the membrane module as illustrated.

30) As one of ordinary skill in the art, I would not have been motivated to have modified the system of JP 11076769 to provide for directing the portion of liquid permeate into the membrane module through a first end of the membrane module and through a second end of the membrane module. JP 11076769 appears to disclose a system which performs a backwash by directing permeate to the center of membrane modules. To direct the portion of liquid permeate into the membrane module through a first end of the membrane module and through a second end of the membrane module would appear to be impossible in the system of JP 11076769, and could not be accomplished without fundamentally altering the configuration and operation of the apparatus disclosed while providing no further benefit or providing a solution to any disclosed problem with said apparatus.

31) In summary, as one of ordinary skill in the art, I would not have been motivated to have combined the apparatus disclosed in any of Smith, Sunaoka, Kopp, Cote, and JP 11076769 with any features of apparatus disclosed in any other of these references to obtain an apparatus capable of performing the method recited in independent claim 1 of the present application.

32) I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

30/10/09

Dr. Fufang Zha **Date**